

Space Weather Technical Forecast

Issued on Wednesday, 26 January 2022 at 13:29 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales <https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales>

Space Weather Forecast Headline: Slight chance G1/Minor Geomagnetic Storm, mainly 26 and 28 January. Slight chance throughout of M-class flares. Slight chance of Active fluence.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been low through the last 24 hours, with several C-class flares, the most energetic of these, a C9.9 at 25/2349 UTC from a region which has recently rotated onto the northeast limb. This region is classified as a Bxo/beta, although more complexity may become apparent as the region moves into a more Earth-facing position. Many of the remaining C-class flares appear to be attributed to AR2936 in the northeast quadrant, which has developed a number of extra spots during the last 12 hours. The remaining regions appear to be stable and relatively inactive. A CME which lifted from near AR2935 on 25 January has been assessed as likely passing over the Earth, but with a chance of a glancing arrival around 29/0000UTC +/- 9 hours.

Solar Wind / Geomagnetic Activity: The solar wind, as observed at L1, increased from around 400km/s, to a peak of close to 500km/s, but has since declined to around 450km/s. This appears to be due to the continued effects of the high speed stream from coronal hole 46. Density has been around average. Total magnetic field strength declined from a peak of around 10nT at the start of the period, and has been weak since 25/1600 UTC. Bz initially varied moderately, between +6nT and -9nT, but has only varied weakly since 25/1600UTC. Phi angle was initially indeterminate, but has been mainly positive (away from the Sun) since 26/0000UTC. Geomagnetic activity was generally Quiet to Unsettled (Kp 1-3).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) measured at GOES 16 was at background levels. The high energy electron flux (greater than 2MeV), was at background to moderate levels. Electron fluence started above the Active threshold (1e8 integrated pfu), but showed a sharp drop after 25/1200 UTC, falling to 5.9e6 integrated pfu measured at 26/0000 UTC.

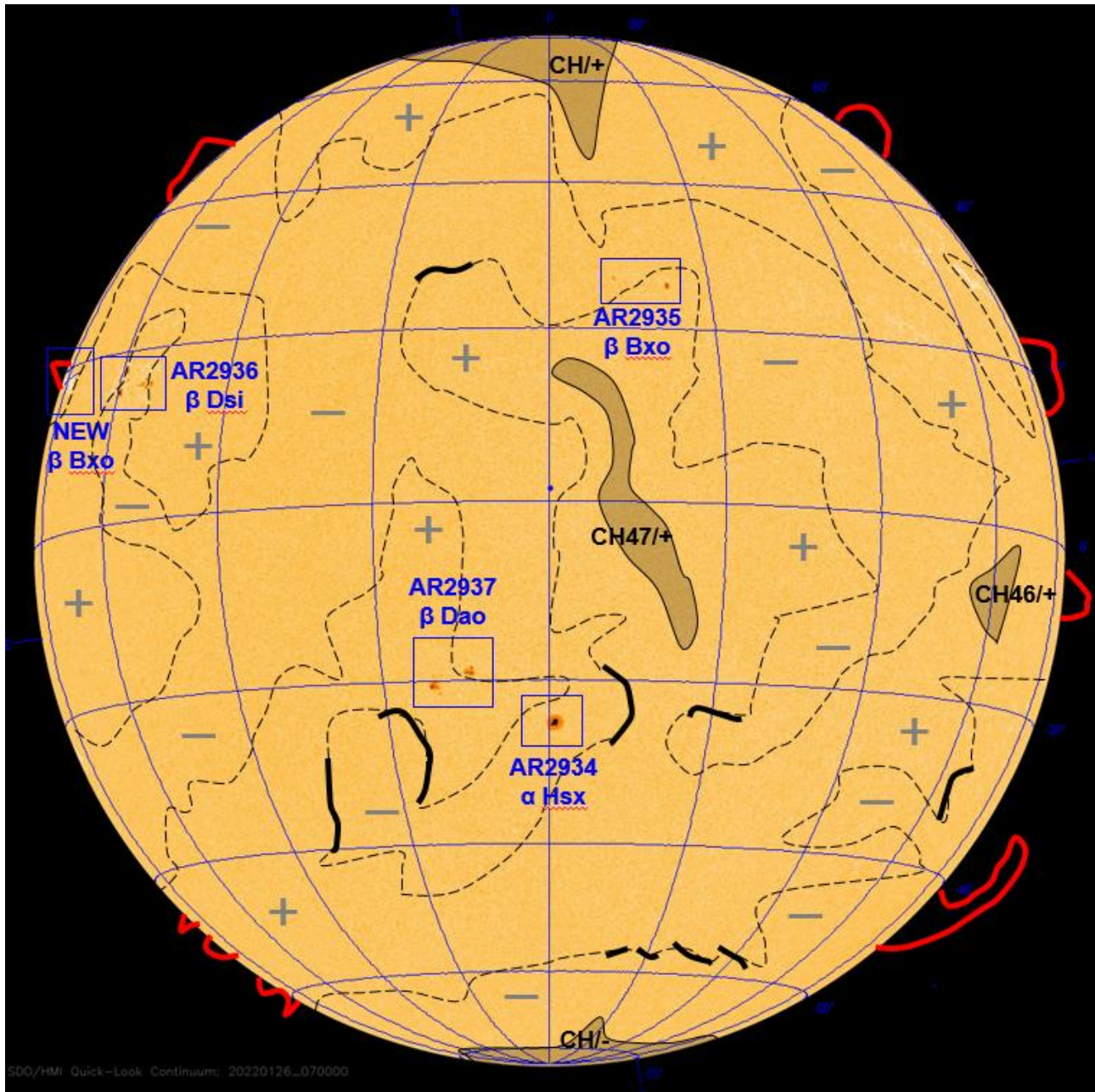
Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to remain low, with five active regions on the visible disc, and potentially two further regions likely to rotate on. There is a slight chance of M-flares.

Solar Wind / Geomagnetic Activity: A CME which left the Sun on 22 January, may have arrived at Earth, but data is inconclusive, with a possibility of this arriving later on 26 January. A further CME glancing blow is possible on 29 January, although this is considered more likely to miss the Earth. The high speed stream from coronal hole 46 is expected to decline through 26 January and into 27 January. The next high speed stream, from coronal hole 47, is then expected to connect with the Earth either on 27 or 28 January. Quiet to Unsettled intervals are expected at first on 26 January, with a chance of Active intervals or a slight chance of G1/Minor Storms due to the possible CME arrival. Activity is then expected to be Quiet to Unsettled on 27 and 28 January, with a chance of Active intervals due to the coronal hole onset, and a very slight chance of G1/Minor Storm intervals. There is a further low risk of G1/Minor Storms on 29 January due to the possible CME, but otherwise Quiet to Unsettled intervals are expected.

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux is forecast to remain at background levels. The high energy electron flux (greater than 2MeV) is currently at background to moderate levels, and likely to persist as such, perhaps peaking briefly at high levels once the current high speed stream eases. The associated 24 hour electron fluence is currently below the Active ($1e8$ integrated pfu) threshold, with any further Active fluence dependent upon the easing of the high speed stream and limited geomagnetic activity through the remainder of the period.

Figure 1. Solar Analysis Valid 26/0800 UTC.



Key: Filament ____, Prominence ____, Magnetic Field Line - - -, Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α - β - γ - δ and Zurich-McIntosh Axx etc.

Geomagnetic Storms:

A CME which left the Sun on 22 January was forecast to arrive at Earth around 26/0000UTC +/- 12 hours. This may have arrived weakly at Earth, but the signal is indistinct, so the risk of a delayed arrival is maintained. A further CME, which left the Sun at 25/0220UTC may arrive at Earth at 29/0000UTC +/-9 hours, with a slight chance of a glancing impact, although this feature is most likely to pass to the north of the Earth.

Solar wind speeds are currently enhanced, due to the high speed stream from coronal hole 46. Speeds peaked at close to 500km/s, but are expected to decline from late on 26 January. The high speed stream from coronal hole 47 is then expected to connect with the Earth either late on 27 January, or during 28 January. On the last rotation, the speeds from this recurrent feature reached close to 600km/s, with a similar speed possible this time following analysis of STEREO A data.

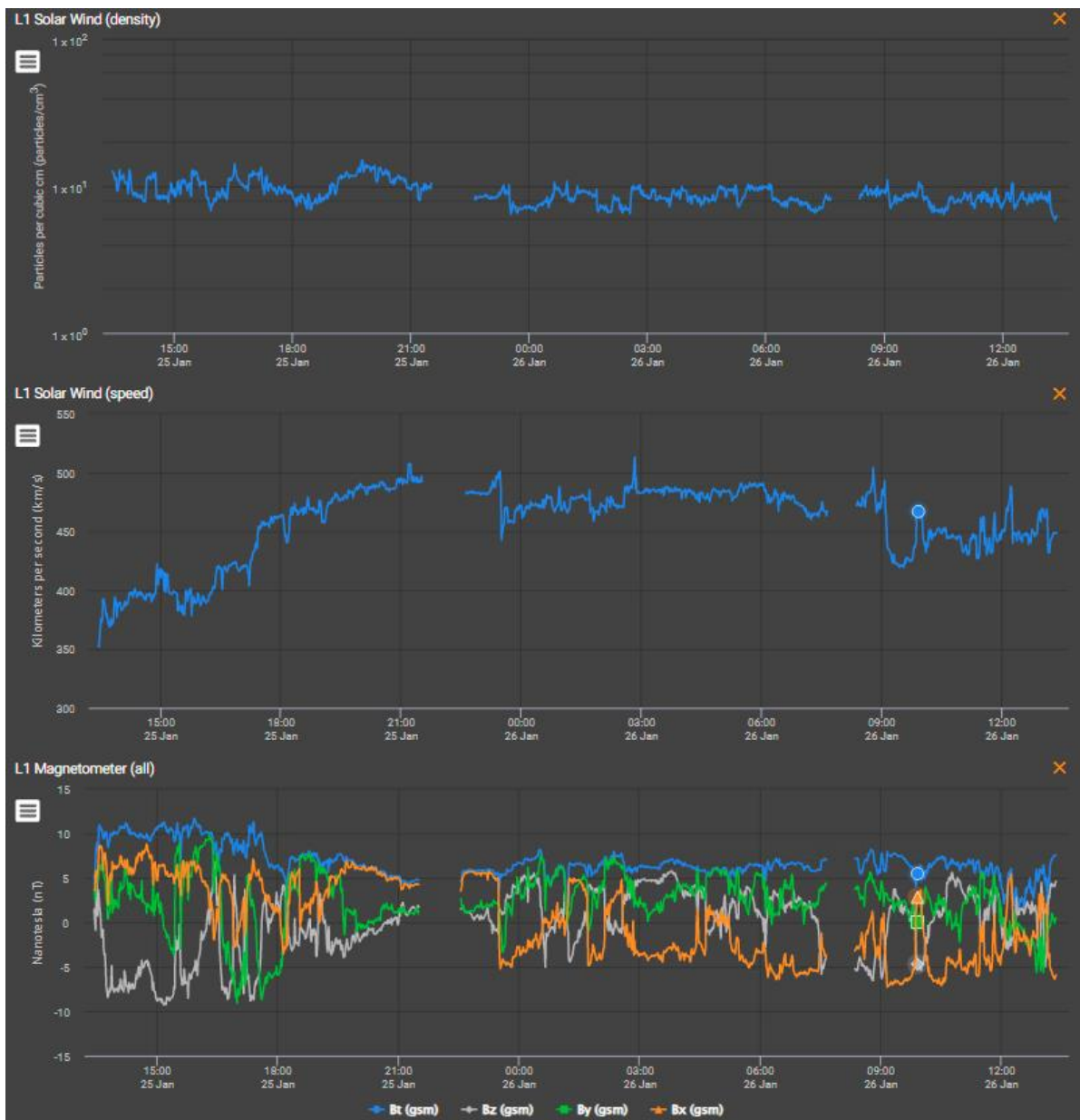
Quiet to Unsettled intervals are expected at first on 26 January, with a chance of Active intervals or slight chance of G1/Minor Storms due to the possible CME arrival. Activity is then expected to be Quiet to Unsettled on 27 and 28 January, with a chance of Active intervals due to the coronal hole onset, and a very slight chance of G1/Minor Storm intervals. There is a further low risk of G1/Minor Storms on 29 January due to the possible CME, but otherwise Quiet to Unsettled intervals are expected.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	20	5	10	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
22/0630	Partial	Filament	N15 E20	400	26/0000UTC	Possible late glancing arrival
25/0220	Partial	Filament	N23 E01	376	29/0000UTC	Likely missing, low chance glance

Figure 2: Recent solar wind parameters at L1



Radio Blackouts - X-Ray Flares:

Solar activity is currently Low, with several C-class flares, 2 of which appear to have emanated from a region just on the northeast limb. This is a new region which is currently difficult to analyse, but currently classified as a Bxo/Beta.

There are four further regions on the visible disc. The most active of these appears to be AR2939 (Dsi/Beta) which is a slowly evolving region in the northeast quadrant and may have been responsible for a minor C-flare in the last 12 hours. All the remaining regions appear to be stable and generally inactive.

In addition to the regions on the Earth-facing disc, two bright flux regions are visible on STEREO EUVI imagery which may rotate into view during the next two days. Low solar activity is expected over the next four days, with a slight chance of M-class flaring.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	15	15	15	15
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux, as measured by GOES-16 is at background levels. No solar radiation storms are expected in the period, with the sunspots on the west of the Earth-facing side of the Sun all currently considered unlikely to give large flares.

Radiation Storms	Level (cm ⁻² sr ⁻¹ s ⁻¹)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = cm⁻²sr⁻¹s⁻¹)

High Energy Electrons Event ($\geq 2\text{MeV}$):

The high energy electron flux (greater than 2MeV) has dropped out due to increased geomagnetic activity late on 25 or early on 26 January. Although the electron flux is likely to start recovering as the radiation belts return to their orbits and geomagnetic activity declines, further geomagnetic enhancements are possible on 27 or 28 January and perhaps 29 January, which could result inhibit any increase above moderate levels. There is only a very slight chance of electron flux reaching the high ($1\text{e}3$ pfu) threshold.

Associated electron fluence has declined sharply over the last 24 hours in response to the decline in electron flux. This is expected to increase as the radiation belts relax into their orbits and due to the high speed stream, but there is only a slight chance of fluence reaching the Active ($1\text{e}8$ integrated pfu) by the end of the period.

GEO Electron Environment	Level ($\text{cm}^{-2} \text{sr}^{-1} \text{day}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^8$	Yes	5	20	30	30
Very Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^9$	No	1	1	1	1

Figure 3: MOSWOC REFM model

